Space Weather Technical Forecast

Issued on Monday, 04 March 2024 at 00:47 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-Class flares throughout, and Active geomagnetic intervals at first on day 1 (04 Mar).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the last 24 hours, with a peak C3.1 flare at 03/1730UTC from ex-AR3590, which is now located beyond the northwest limb.

There are currently six numbered and one un-numbered sunspot regions on the visible disc, with the un-numbered region having recently emerged in the northeast quadrant as a small cluster of spots with a bipolar configuration. AR3598 remains the most complex bipolar group with a number of intermediate spots, although appears stable at this time with some slight decay evident. AR3595 is moderately complex with large lead and trailer, but few other spots, and only small changes in overall structure. The remaining regions are currently simple and much smaller.

No new Earth-directed Coronal Mass Ejections (CMEs) were observed in imagery.

Solar Wind / Geomagnetic Activity: Solar winds observed at L1 by ACE/DSCOVR were largely representative of a background solar wind environment, with winds below 300km/s, until around 03/0845UTC. From this time solar wind parameters became enhanced due to a CME arrival. Speeds increased then levelled, in the range 330-390km/s. Density was generally below average, but increased to above average following the CME arrival, peaking at 38ppcc at 03/1142 UTC. Latest observations have seen a return to below average levels. Total magnetic field strength, IMF, was generally weak, below 5nT, but increased sharply following the CME onset, becoming moderate to strong, with a peak of 19nT (strong) at 03/1108 UTC. The north-south component, Bz was weak and mostly negative prior to the CME, but strengthened significantly thereafter, varying between +17/-17nT. Phi angle was predominantly negative (towards the Sun) until around 03/1500UTC, then became mostly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1 to 3) until 03/1200 UTC, then became G1-G2/Minor to Moderate storm 03/1200-2100 UTC), with an Active interval (Kp 4) to finish the UTC day.

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background levels with the associated 24 hour fluence well below the Active (1e8 integrated pfu) threshold. The observed 24-hour fluence at 04/0000UTC was 3.5e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is expected, with a chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: Ongoing effects from one or more CMEs that arrived

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earlier on 03 Mar should diminish by early day 1 (04 Mar) with no further CMEs in the current forecast. Otherwise Earth is expected to remain in a background solar wind environment with no significant coronal hole high speed streams expected. Unsettled to Active Geomagnetic activity at first on day 1 (04 Mar), with a very slight chance of a G1/Minor Storm interval from lingering CME effects. Then easing to become generally Quiet from day 2 (05 Mar) onwards.

Energetic Particles / Solar Radiation: GOES18 high energy proton flux is likely to stay at background levels, but with a slight chance of rising above S1 levels on day 1 (04 Mar) in response to any notable flares, mainly from ex-AR3590 as this region rotates further beyond the northwestern limb. GOES16 high energy electron flux is expected to remain generally at background, occasionally moderate levels with the associated 24hr fluence remaining well below the Active threshold throughout.

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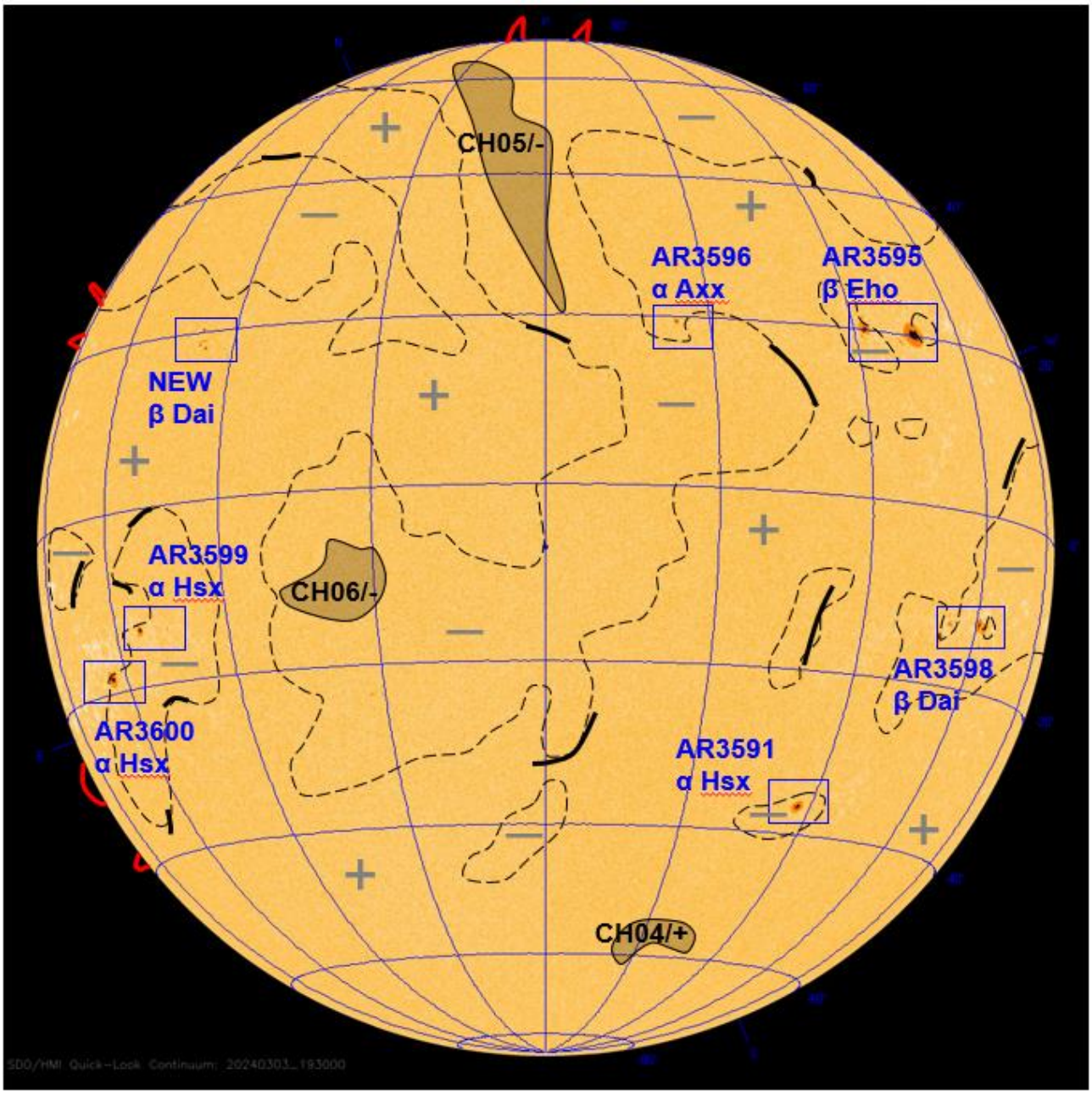
Figure 1. Solar Analysis Valid 04/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Ongoing effects from one or more CMEs that arrived at Earth early on 03 Mar should steadily diminish on day 1 (04 Mar). No further CMEs currently feature in the forecast.
Despite the recent CME arrival, slow-ambient solar wind speeds are still being observed at L1 and are expected to remain at background levels with no significant enhancements anticipated during the period.

Unsettled to Active Geomagnetic activity at first on day 1 (04 Mar), with a very slight chance of a G1/Minor Storm interval from lingering CME effects. Then easing to become generally Quiet from day 2 (05 Mar) onwards.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	10	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

Figure 2: Solar wind parameters at L1 from ACE/DSCOVR showing CME passage.

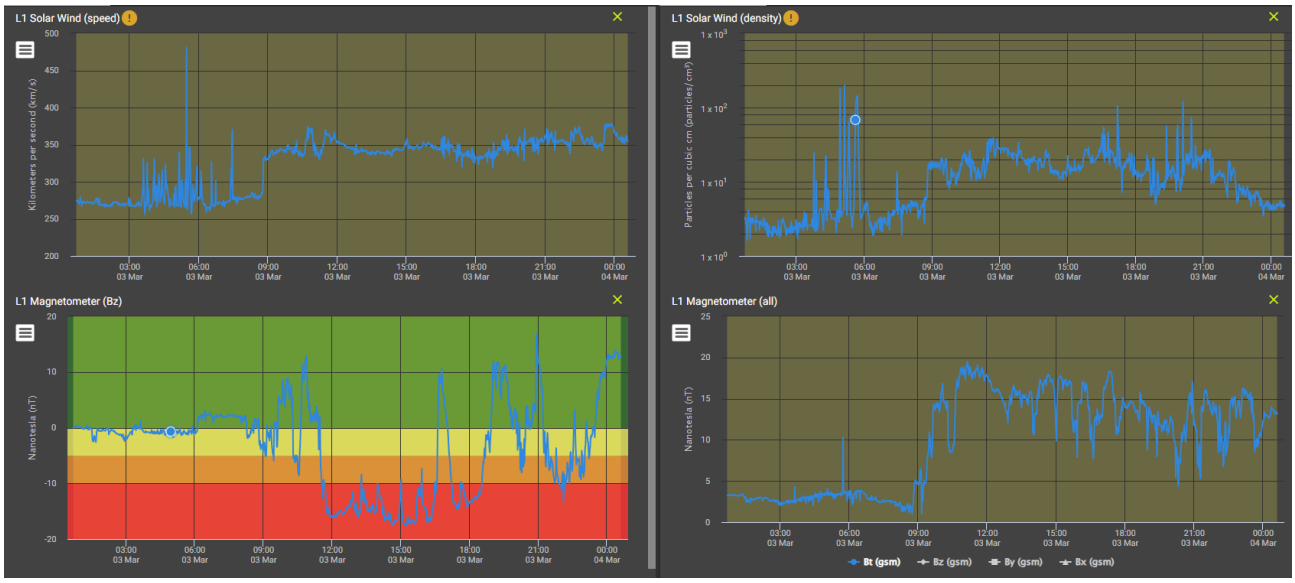

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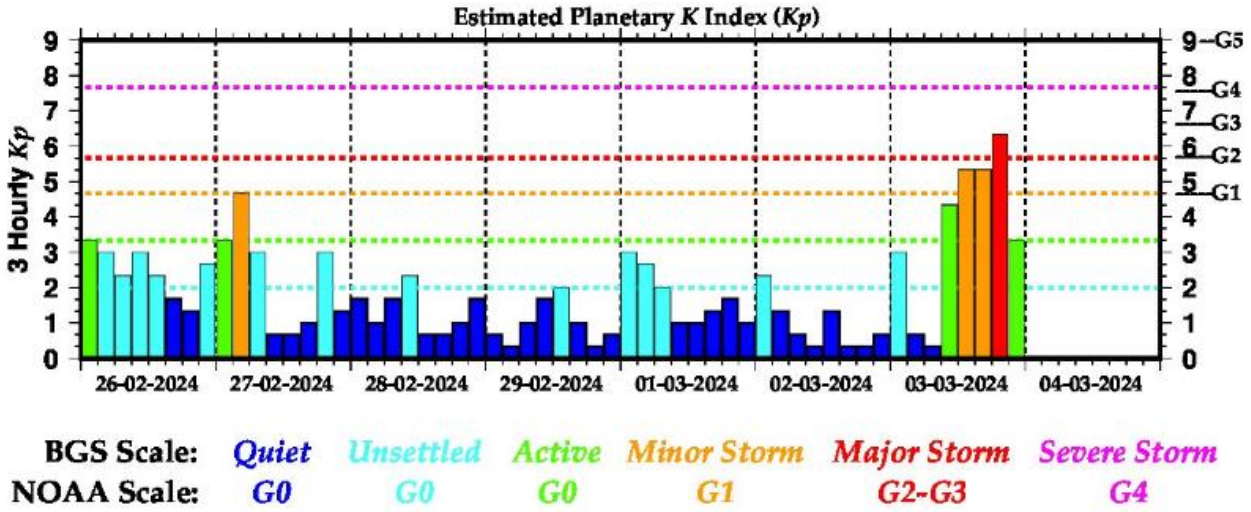
Figure 3: BGS plot of planetary K indices showing the enhanced geomagnetic activity on 03 March.



Radio Blackouts - X-Ray Flares:

There are currently six numbered and one un-numbered sunspot regions on the visible disc, with the un-numbered region having recently emerged in the northeast quadrant as a small cluster of spots with a bipolar configuration. AR3598 remains the most complex bipolar group with a number of intermediate spots, although appears stable at this time with some slight decay evident. AR3595 is moderately complex with large lead and trailer, but few other spots, and only small changes in overall structure. The remaining regions are currently simple and much smaller. Ex-AR3590 rotated off the northwest limb during 2 March, but could potentially still produce flares which could be visible at Earth from beyond the limb through the next 12-24 hours.

Low solar activity is expected, with a chance of isolated M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	1	1	1

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Solar Radiation Storms - (High Energy Protons):

GOES-18 proton flux is currently at background levels, and is likely to remain so through the period. There is just a slight chance of enhancement from any major flare associated with ex-AR3590 from the far side of the northwest limb, with this risk decreasing through the next 24 hours.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	5	5	5
Very Active	**≥ S3 ***	No	2	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is expected to remain generally at background, occasionally moderate levels in the absence of any significant solar wind inputs.

Corresponding high energy electron fluence is expected to remain well below the Active threshold (1e8 integrated pfu).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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